Claims

1. A method of performing model-based optical proximity correction comprising:

embedding wavefront information on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;

generating a phase map from said wavefront information;

computing a point spread function from said phase map; and

performing optical proximity correction calculations using said point spread function.

2. The method of claim 1 wherein said step of embedding wavefront information comprises embedding simulated wavefront information from randomly generated data.

3. The method of claim 1 wherein said step of embedding wavefront information comprises embedding empirically derived wavefront data.

4. The method of claim 2 comprising:

forming said first two-dimensional complex array comprising a plurality of complex numbers having amplitude and phase;

obtaining a complex conjugate array corresponding to said first two-dimensional complex array;

arranging said first two-dimensional complex array into a symmetric complex array using said complex conjugate array;

performing an analytic filtering function on said symmetric complex array;

applying a power law function to said symmetric complex array;

computing said wavefront by performing a Fourier Transform on said symmetric complex array, resulting in a transformed array;

obtaining a circular core of said transformed array of a diameter equal to said first array's assigned diameter, and converting to zero coordinates outside said diameter; and

normalizing amplitudes of said transformed array.

5. The method of claim 4 wherein said step of forming said first two-dimensional complex

array further comprises putting said array elements in phasor form with a phase within a range of 2π.

6. The method of claim 5 including said phasor having an amplitude in the range of 0 to a predetermined small fraction less than 1.

7. The method of claim 5 wherein said first two-dimensional complex array size is represented by the log in base two of said first two-dimensional complex array's assigned diameter.

8. The method of claim 4 wherein said complex numbers are centered within said first two-dimensional complex array.

9. The method of claim 4 wherein said step of arranging said first two-dimensional complex array into said symmetric complex array further includes equating each amplitude of said first two-dimensional complex array with a corresponding amplitude of said complex conjugate array.

10. The method of claim 4 wherein said step of arranging said first two-dimensional complex array into said symmetric complex array further includes equating each phase of said first two-dimensional complex array coordinate pair with the inverse of a corresponding phase of said complex conjugate array.

11. The method of claim 4 wherein said step of performing an analytic filtering function includes multiplying said amplitude of each of said complex number by an apodizing function.

12. The method of claim 11 further including filtering out low spatial frequency aberrations.

13. The method of claim 4 wherein said step of applying a power law function on said symmetric complex array comprises multiplying said amplitude of each of said complex number by the sum of the squares of each of said coordinate pair, said sum raised to a power.

14. The method of claim 13 wherein said power comprises a supplied user function in the form of $\gamma/2$ with γ in the range of 1 to 3.

15. The method of claim 4 wherein said Fourier Transform is a two-dimensional Fast Fourier Transform.

16. The method of claim 15 including assigning each phase of said complex number to zero after said transform.

17. The method of claim 4 wherein said step of normalizing said transformed array's amplitudes comprises:
subtracting an average value of said wavefront from each array element; and
replacing each of said elements by an analytical expression, which is a function of both a square root of intrinsic flare and a radius of said wavefront.

18. The method of claim 4 including: shuffling said elements such that said element in said first array's center is shifted to said first array's bottom-left corner.

19. The method of claim 18 further including:
ignoring a first row and first column of said first array;
dividing said first array's remaining portion into four quadrants;
exchanging a first quadrant with a second quadrant, and exchanging a third quadrant with a fourth quadrant;
exchanging said first and said fourth quadrants;
exchanging said second and said third quadrants;
converting said elements into real and imaginary form;
unshuffling said elements such that said first array is again centered following said Fourier Transform; and

converting said first array into phasor form.

20. The method of claim 3 further comprising:

reading said empirically derived wavefront data in a row major order by substituting zero for ignored data; and

centering said empirically derived wavefront data.

21. The method of claim 20 further comprising:

obtaining a circle enclosing said empirically derived wavefront data; and

embedding and centering said circle within a square array such that said circle has a diameter represented by an equal number of rows and columns of said array expressed as a value equal to 2 raised to the power of the log of the sum of said diameter plus one.

22. The method of claim 19 further comprising:

exponentiating empirically derived wavefront information resulting in an array of complex numbers in phasor form;

embedding said exponentiated wavefront in a larger array having a center such that if a linear dimension of said wavefront array is given by log diameter p, then a corresponding linear dimension of said larger array is given by log diameter q, where q is at least p+3;

shuffling said larger array to move said center to a bottom-left quadrant;

performing an inverse Fast Fourier Transform on said larger array to obtain a transformed array;

unshuffling said transformed array to move said complex numbers from said bottom-left quadrant back to said center;

normalizing the magnitude of the unshuffled array;

choosing amplitude values of said normalized array and creating a phase map;

using said phase map to compute a point spread function array; and

scaling said point spread function array from pixel dimension to real dimension.

23. The method of claim 22 wherein said array of complex numbers further comprises phase

values which are the same as corresponding amplitude values.

24. The method of claim 22 including amplitude values assigned to unity.

25. The method of claim 22 further wherein said large array includes a number of rows and columns calculated by a value equal to 1 added to 2 raised to the p power.

26. A method of performing model based optical proximity correction on a lithographic mask pattern incorporating phase maps comprising:

incorporating a point spread function array in real dimension within a set of convolution kernels; and

computing an aerial image with aberrations using said set of convolution kernels.

27. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for performing model-based optical proximity correction, said method steps comprising:

embedding wavefront information on a first two-dimensional complex array having a plurality of array elements and an assigned diameter;

generating a phase map from said wavefront information;

computing a point spread function from said phase map; and

performing optical proximity correction calculations using said point spread function.

28. The program storage device of claim 27 wherein said step of embedding wavefront information comprises embedding simulated wavefront information from randomly generated data.

29. The program storage device of claim 27 wherein said step of embedding wavefront information comprises embedding empirically derived wavefront data.

30. The program storage device of claim 28 comprising:

forming said first two-dimensional complex array comprising a plurality of complex numbers having amplitude and phase;

obtaining a complex conjugate array corresponding to said first two-dimensional complex array;

arranging said first two-dimensional complex array into a symmetric complex array using said complex conjugate array;

performing an analytic filtering function on said symmetric complex array;

applying a power law function to said symmetric complex array;

computing said wavefront by performing a Fourier Transform on said symmetric complex array, resulting in a transformed array;

obtaining a circular core of said transformed array of a diameter equal to said first array's assigned diameter, and converting to zero coordinates outside said diameter; and

normalizing amplitudes of said transformed array.